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Applicant		
EXXONMOBIL UPSTREAM RESEARCH COMPANY		
Title of the Invention		
LNG CONTAINMENT SYSTEM AND METHOD OF ASSEMBLING LNG CONTAINMENT SYSTEM		

VIA EXPRESS MAIL

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RESPONSE TO WRITTEN OPINION MAILED 12 JANUARY 2006

Sir:

The Written Opinion has been reviewed and consideration is requested for the following, in view of fresh pages 10, 18, and 26 enclosed herewith.

Page 10 is corrected to delete the erroneous word "may" in [0055].

Page 18 is corrected to replace the inadvertent reference to **Figure 10A** instead of **Figure 9A** in [0081].

Page 26 amends claim 20 to insert the connector "and" used in series, to correct "wall" to "roof" in claim 23 (as pointed out in the Written Opinion), to elaborate on the barrier layer of the invention, and to delete the superfluous "and" before the final wherein clause of claim 23.

Novelty and inventive step of the claimed subject matter of claims 1-19 is gratefully noted.

Claims 23-25 were found to lack novelty over US Patent No. 4,282,619 ("Rooney") for the disclosure of a steel truss structure, a steel barrier layer placed atop the truss structure, and a concrete plate placed over the barrier. Reconsideration is requested.

Rooney is taken from the bridge construction art and all of the elements of Rooney are designed in an inverted manner from that of the invention since Rooney is providing a bottom structure for traffic. Rooney is concerned with forces in a direction from the concrete to the steel truss; i.e., road traffic forces on the bridge. The present invention is also concerned with forces, and barrier, in the opposite direction from the truss to the concrete of the roof. Furthermore, the invention is concerned with completely covering the truss structure against pressure from the direction of the truss and with the escape of vapor and liquid from within.

Significantly, Rooney *does not* disclose a "barrier layer place over the steel truss structure", as required by the second element of claim 23. Rather, Rooney discloses at column 6, lines 12-57 that the composite steel and concrete composite precast structural sections 48 are individual sections that do not adjoin side-by-side but rather have stitch weld connections which may later be filled with grout or asphalt. There is no teaching that such grouting is suitable to withstand the pressures associated with a full containment system. In any case the plates 50 do not constitute a barrier layer, especially one spanning the width and length of a roof's steel truss structure for a secondary container. Support for the amending language may be found in the specification in [0077]. Reconsideration and a favorable opinion regarding claims 23-25 is respectfully requested.

Claims 20-22 were found to lack inventive step over US Patent No. 6,673,412 ("Ramesh") and US Patent No. 6,484,464 ("Ochoa"). Ochoa discloses a panel with a steel beam and Ramesh suggests placing moisture and other layers atop the concrete. Reconsideration is requested.

While Ochoa uses the term "wall" for its sections, these references are clearly to horizontal sections used as roofs and floors, unlike the vertical walls of the invention. Moreover, the drawing figures and discussion in the paragraph bridging columns 6 and 7 of Ochoa clearly reveal that the roof/floor panels of Ochoa have a joist 12 that is embedded within the concrete panel rather than "connected along the outer surface of the concrete plate" as specified in claim 20. Also, there is no teaching for joinder of such panels. Accordingly, the primary reference fails to describe or suggest the invention as claimed.

Ramesh merely refers to the background art in flooring that uses barrier layers for cushioning whereas Ramesh, at column 2, suggests low water vapor transmission rate materials instead. Nevertheless, Ramesh does not disclose vertical walls and does not provide a wall panel suitable for a secondary container in a full containment LNG system (having pressure, LNG liquid/vapor transmission, temperature, and strength requirements). Since the combination of Ramesh and Ochoa do not show a secondary wall panel having a steel beam along the outer surface and do not show the additional characteristics of dependent claims 21 and 22, reconsideration and a favorable opinion are solicited.

Respectfully submitted,

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[0054] **Figure 1** presents a perspective, cutaway view of a containment structure **100**, in one embodiment. The containment structure **100**, in its most general form, comprises an external secondary container **200** and at least one inner primary container **300**. A primary container **300** is seen in the cutaway portion of the secondary container **200**. The primary container **300** is designed to hold liquefied natural gas ("LNG") at cryogenic temperature and in an insulated manner. At the same time, the secondary container **200** is designed to serve as a "back-up" to the primary container **300** in the event that the primary container **300** loses fluid integrity.

[0055] A secondary container of an LNG storage system fulfills several functions. During normal operations, the outer, or "secondary" container holds the insulation in place and provides protection to the inner, primary tank against the elements of nature. Under extreme conditions when the inner tank is assumed to fail and no longer able to hold the cryogenic liquid, the outer tank is called upon to hold full contents of the inner tank safely and to permit both controlled withdrawal of the contained liquid and controlled release of the product vapor. In this event, a severe set of loads is imposed on the outer tank. Not only is the outer tank subjected to the hydrostatic loads applied by the liquid now contained by it, but the outer wall is also subjected to a 'thermal shock' loading due to sudden exposure to the very low temperatures of the LNG liquid. The inner wall and floor surfaces of the secondary container experience a sudden and severe drop of temperature while the outer surfaces of the secondary container wall remain exposed to ambient temperature. This causes severe stresses in the secondary container at junctures such as wall-floor interfaces. Thus, a secondary container **200** is preferably designed to accomplish one or more of the following: (1) withstand hydrostatic forces upon fluid leakage from the primary container **300**, (2) contain liquids that might escape from the primary container **300**, (3) provide gas tightness from gases that will form when liquid escapes from the primary container **300**, and (4) withstand thermal shock created if and when extremely cold fluids from the primary container **300** contact the inner surfaces of the secondary container **200**.

by pouring concrete on top of the steel plate **264** of the roof building block. Post tensioning of the roof concrete layer **266** may not be necessary in these arrangements.

[0079] In addition to providing a secondary container for an LNG containment system **100**, a method is also provided herein for assembling an LNG containment system, such as system **100**. Construction of containment system **100** is expedited by using the above-described secondary container embodiments **200**. The secondary container **200** is erected over a concrete tank floor (seen at **250** in **FIG. 1**). More specifically, individual walls, e.g., end walls **212, 214** and side walls **222, 224** are formed by vertically erecting and attaching various panels (shown at **230** in **FIG. 3**) side-by-side. This is a segmental technique that uses off-site prefabrication of building blocks that can be assembled into a structural system.

[0080] Known full containment systems typically demand a relatively long construction schedule. The sequential construction of storage system elements normally starts with the construction of a cast-in-place outer tank slab and walls. Only after the domed roof has been constructed on the outer tank walls is construction on the internal structures, including the bottom insulation and inner steel tank, started. This means that the inner steel tank is constructed in-situ after the secondary container has been at least substantially completed. A construction schedule of 36 months for a now typical 160,000 m^3 full containment LNG storage tank is normal. This long construction schedule is often on the critical path for an LNG facility construction project, causing a potential source of delay. Therefore, an improved method for assembling an LNG containment system is offered.

[0081] **Figures 9A-9F** present sequential steps for construction of a full containment LNG tank **100**, in one embodiment. The full containment tank **100** will include one or more inner tanks **300** and a surrounding outer tank **200**. First, **Figure 9A** shows the formation of a concrete floor slab **250**. In this embodiment, the "footprint" of the slab **250** is rectangular. In addition, a vertical end wall **212** has been erected over an end of the floor slab **250**. The end wall **212** has been assembled by adjoining prefabricated combination wall panels (such as those shown at **230** in **Figure 3**) in side-to-side fashion. The wall panels **230'** may be individual wall

erecting at least one final vertical wall on the floor slab so as to form a polygon having at least four sides and so as to enclose the primary container within the secondary container.

20. A wall panel for a secondary container, the secondary container being employed with a full containment LNG system, the wall panel comprising:

a concrete plate having an inner surface, an outer surface, and a longitudinal axis;

at least one steel beam connected to the concrete plate along the outer surface of the concrete plate, and along the longitudinal axis; and

wherein the wall panel is configured so that a plurality of wall panels may be adjoined in side-to-side fashion so as to form a wall of a secondary container for the full containment LNG system.

21. The wall panel of claim 20, further comprising:

a moisture barrier disposed on the concrete plate opposite the at least one steel beam.

22. The wall panel of claim 21, further comprising:

an insulation layer along the moisture barrier opposite the at least one steel beam; and

a liner plate on the insulation layer.

23. A roof panel for a secondary container, the secondary container being employed with a full containment LNG system, the roof panel comprising:

an elongated steel truss structure;

a barrier layer placed over the steel truss structure;

at least one thin concrete plate placed over the barrier layer along a longitudinal axis of the concrete plate; and